Original Article

Nanofiber Expansion of Umbilical Cord Blood Hematopoietic Stem Cells

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Background

The aim of this study was the ex vivo expansion of Umbilical Cord Blood hematopoietic stem cells on biocompatible nanofiber scaffolds.

Materials and Methods

CD133+ hematopoietic stem cells were separated from umbilical cord blood using MidiMacs (positive selection) system by means of monocolonal antibody CD133 (microbeads); subsequently, flowcytometry method was done to assess the purity of separated cells. Isolated cells were cultured on plate (2 Dimensional) and fibronectin conjugated polyethersulfon nanofiber scaffold, simultaneously (3 Dimensional). Colony assay test was performed to show colonization ability of expanded cells.

Results

Cell count analysis revealed that expansion of hematopoietic stem cells in 2dimensional (2D) environment was greater than 3dimensional (3D) condition (p= 0.01). Assessment of stem cell-phenotype after expansions was performed by flowcytometric analysis which is showed that the maintenance of CD133 marker in expanded cells in 3 dimensional condition were higher than expanded cells in 2 dimensional condition (p=0.01). Moreover, colony assay test was performed before and after of expansion to show colonization ability of expanded cells both in 3D and 2D culture and results revealed more ability of 3D culture compared with 2D culture (p= 0.03).

Conclusion

The results of current study confirmed that umbilical cord blood CD133+ haematopoietic stem cells are able to expand on fibronectin conjugated polyethersulfon scaffold. These findings indicated that 3D is a proper and valuable cell culture system for hematopoietic stem cells expansion, compared to 2D in invitro situation.

Keywords

Umbilical cord blood, Polyethersulfon, Nanofiber scaffold

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Introduction

Hematopoietic stem cell transplantation (HSCT) is a therapeutic approach in treatment of hematological and non hematological disorders; nevertheless, finding suitable donors for patients is barrier to use them. Hematopoietic stem cells are the rare progenitor cells found mainly in bone marrow and alternatively in peripheral blood and umbilical cord blood. CD133+ hematopoietic stem cells are